
CHAPTER 14

CONFINED SPACES

SAFETY AND HEALTH PROCEDURES FOR CONFINED SPACES

TABLE OF CONTENTS

14.00	INTRODUCTION
14.01	PURPOSE
14.02	POLICY STATEMENT
14.03	DEFINITION OF A CONFINED SPACE
14.04	HAZARDS OF CONFINED SPACES
14.05	ROLES AND RESPONSIBILITIES
14.06	TRAINING REQUIREMENTS
14.07	OPERATING PROCEDURES
14.08	EMERGENCY/RESCUE PROCEDURES
14.09	WET/DRY PIT PUMPING PLANTS
14.10	GASOLINE/DIESEL POWERED EQUIPMENT
14.11	AIR MONITORING EQUIPMENT SELECTION
14.12	AIR MONITORING INSTRUMENTS
14.13	DOCUMENTATION - CONFINED SPACE ENTRY FORM
14.14	REQUIREMENTS FOR CONTRACTORS
14.15	CONFINED SPACE GUIDELINES CHECKLIST

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14-2

CONFINED SPACES

THIS SPACE AVAILABLE FOR NOTES:

CHAPTER 14

CONFINED SPACES

SAFETY AND HEALTH PROCEDURES FOR CONFINED SPACES

14.00 INTRODUCTION

This chapter represents the Department's written Confined Space Program as required by the General Industry Safety Orders (GISO), Sections 5156 through 5158.

14.01 PURPOSE

The purpose of this chapter is to familiarize supervisors and employees with the Department's Confined Space Program, the hazards of confined spaces, monitoring equipment, operating procedures, and other relevant information to prevent injury or illness during confined space operations.

NOTE:

- **Maintenance Program employees** will also follow the applicable Maintenance Code of Safe Operating Practices, "Pump House Maintenance", and/or "Appendix A - Confined Space Entry Procedures", a copy is included at the end of this chapter.
- **Construction Program employees** and **Structures Program employees** will also follow the applicable Construction Code of Safe Practices, "Confined/Enclosed Spaces", and "Appendix A-1 - Confined Space Entry Procedures", a copy is included at the end of this chapter.
- Use the "Confined Space Guidelines", included at the end of this chapter, as a checklist for confined space operations.

14.02 POLICY STATEMENT

Caltrans employees will not enter a confined space or potential confined space unless they have been trained in and are following the requirements and procedures described in this chapter.

14.03 DEFINITION OF A CONFINED SPACE

A confined space is any location that meets the following definition:

1. an employee can physically enter, and
2. has limited or restricted means of entry or exit, and
3. is not designed for continuous employee occupancy.

Confined spaces include structures or facilities such as tanks, bridge cells, shafts, pits, bins, tubes, pipelines, deep trenches, vaults, vats, pump houses or compartments, sewage lift stations, culverts, cofferdams, elevator pits, or similar locations.

NOTE:

For contract administration purposes, construction contractors may use a slightly different definition of a confined space. Under the contractor's definition BOTH of the following conditions MUST exist.

1. existing ventilation is insufficient to remove dangerous air contamination and/or oxygen deficiency which may exist or develop, and
2. ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s).

14.04 HAZARDS OF CONFINED SPACES

Confined spaces contain unique hazards that require special training, work procedures, and equipment. These hazards can be divided into two broad categories: a) **atmospheric hazards** (dangerous air), and b) **physical hazards**.

NOTE: The use of gasoline or diesel powered equipment in confined spaces creates special hazards and requires special precautions, see Section 14.10.

a) ATMOSPHERIC HAZARDS (Dangerous Air)

The most common atmospheric hazards of confined spaces are:

- 1) **oxygen deficient/oxygen enriched atmosphere; and/or,**
- 2) **flammable atmosphere; and/or,**
- 3) **toxic atmosphere, and/or,**
- 4) **poor ventilation.**

1) Oxygen Deficient/Oxygen Enriched Atmospheres

An oxygen-deficient atmosphere exists when there is less than 19.5 percent oxygen in the air. An oxygen concentration of 20.9 percent oxygen is necessary for normal breathing.

The following list illustrates some of the dangers associated with different concentrations of oxygen:

- 20.9% oxygen is required for normal breathing;
- 19.5% oxygen is the minimum for safe entry;**
- 16% oxygen causes impaired judgement and breathing;
- 14% oxygen causes faulty judgement and rapid fatigue;
- 6% oxygen causes difficult breathing and death in minutes;
- Permanent brain damage starts after 4 minutes of oxygen deficiency.

Oxygen levels can decrease within a confined space for a variety of reasons:

- Oxidation (rusting) or fermentation can use up oxygen.
- Absorption - charcoal beds can absorb oxygen and remove it from the air.
- Displacement - other gases (carbon monoxide, nitrogen, methane, etc.) can displace oxygen from the space, or make the oxygen unavailable.
- Work processes - procedures using flames (welding, cutting, brazing, heating, burning) can use up oxygen within the space.

Lack of oxygen can cause asphyxiation, which is leading cause of death in confined spaces due to lack of oxygen in the blood. The two general types of asphyxiation are:

- Chemical asphyxiation - carbon monoxide blocks the body's ability to use oxygen.
- Physical asphyxiation - solvents, vapors, oxidation, open flames, and microbial processes displace or remove the oxygen from the air.

An oxygen enriched atmosphere (above 23.5%) can be caused by work processes, or ventilation procedures. An oxygen enriched atmosphere causes combustible materials; such as clothing, hair, wood, oils, or solvents, to burn violently. High oxygen levels can also cause spontaneous combustion, even without a source of ignition.

Never use welding oxygen to ventilate a confined space.

2) Flammable Atmospheres

Because of minimal ventilation and limited air space, flammable materials can create a significant problem in confined spaces. If a flammable gas, vapor, or dust is present in the proper concentration, and an ignition source is introduced, an explosion or flash fire can occur. The lowest concentration in air at which ignition will occur is called the "lower explosive limit" (LEL).

NEVER INTRODUCE ANY SOURCE OF IGNITION OR SWITCH ON ANY ELECTRICAL MOTOR OR LIGHT IN A CONFINED SPACE UNLESS YOU ARE POSITIVE THAT A FLAMMABLE ATMOSPHERE DOES NOT EXIST.

SMOKING IS PROHIBITED INSIDE CONFINED SPACES.

Because the LEL varies for different flammable materials (e.g., gasoline = 1.4%, methane = 5.3%, hydrogen sulfide = 4.0%), Cal-OSHA has established 10% of the LEL as the alarm setting for combustible gas indicators. To provide an extra margin of safety, **Caltrans policy does not allow entry into atmospheres with detectable levels of flammable materials (>1% of LEL).**

There are a number of possible sources for flammable atmospheres in a confined space. These include:

- Gasoline or other flammable liquids from spills or accidents on the highway, that enter the space through drop inlets or drains.
- Paints, thinners, solvents, aerosol sprays, or other flammables being used inside the space.
- Methane and/or Hydrogen Sulfide from decomposition of organic matter inside the space.
- Acetylene and other flammable gases from welding, torching, cutting, brazing, or heating inside the space.
- Flammable liquids or gases entering the space through underground storm drains, pipelines, sewers, etc., or through the ventilation system.
- Carbon monoxide accumulations in tunnel/tube exhaust ducting.

To minimize these sources, the preferred method is to block off, seal, or disconnect all pipelines, drains or vents that would allow flammable liquids or vapors to enter the space. If this is not possible, then the outside attendant must monitor outside conditions and alert the workers inside if something happens; i. e., traffic accident, chemical release, flash flood, sudden rain, etc., that could impact them.

In areas where outside spills and releases occur frequently, a survey of local drains that serve the confined space may be necessary before entry.

Inside sources can be controlled by minimizing the use of flammable materials or processes, and by providing continuous ventilation and monitoring.

To prevent the build-up of flammable or toxic materials, use continuous ventilation and monitoring during work inside confined spaces.

Flammable vapors and gases can be heavier or lighter than air, so proper air monitoring requires checking both near the floor and at the ceiling, particularly in corners and other areas with poor air circulation.

Dusts can also create an explosive hazard. If dusts reduce visibility to 5 feet or less, an explosive hazard may exist. Use additional ventilation or change work practices to reduce dust.

3) Toxic Atmospheres

Confined spaces often contain toxic atmospheres. Work processes may release toxic materials, hazardous materials may enter the space from outside sources, or toxic materials could be stored in the space and then released from the walls or hidden pockets after the space is emptied or the contents are disturbed.

NOTE: Even if the atmosphere tests "OK" for oxygen and flammable gases, a toxic atmosphere can still exist.

Two toxic gases often present in confined spaces are:

Carbon Monoxide - a colorless, odorless gas usually generated in gasoline engine exhaust and combustion devices. Welding and cutting can also create carbon monoxide. Often introduced into confined spaces from outside vehicles and traffic. It can cause asphyxiation and is flammable.

Hydrogen Sulfide - a colorless gas that smells like "rotten eggs" at very low levels, but deadens the sense of smell during continuous exposure to low levels and immediately at higher levels. Fatal in two or three breaths at high concentrations. It originates from decomposition of organic matter and microbe action. Often found in connection with sewer lines and sewage treatment. It is flammable and explosive.

An additional source of toxic gases is materials running into, or being used inside, the confined space. Fuels, paints, bug sprays, lubricants, cleaners, thinners, solvents, and other hazardous materials, particularly those containing petroleum products (e.g., gasoline, xylene, toluene, acetone, etc.) can create toxic atmospheres in confined spaces.

To minimize hazards from work materials used in confined spaces, always review the Material Safety Data Sheet (MSDS) of the material before using it inside a confined space.

Be alert for warning labels that state, “use only in areas with good ventilation”, or, “use indoors requires extra ventilation.” Avoid using materials that warn of drowsiness or intoxication from inhalation of vapors. Avoid materials with a high vapor pressure, this indicates that they readily evaporate. Know the symptoms of overexposure before using these types of materials.

Although many of these materials are also flammable, they are toxic at levels well below the LEL. For example: the LEL for gasoline is 1.4% concentration in air. This equals 14,000 parts per million (ppm). The Cal-OSHA permissible exposure limit (PEL) for 8 hours is 300 ppm, the short term exposure limit (STEL) is 500 ppm for 15 minutes. Even at 10% of the LEL (1400 ppm) the concentration of gasoline vapors is more than four times the allowable exposure.

As shown above, a positive LEL reading (> 1 % above background levels) is a good indication that toxic materials may be present. This is the basis for the Caltrans policy of not exceeding 1% of the LEL while working in confined spaces.

Unfortunately, there are also some materials that are non-flammable and toxic. These require special monitoring equipment and procedures. Careful review of MSDS documents before use can prevent problems.

Dusts are an additional toxic concern in confined spaces. Because of the small spaces involved, operations such as sandblasting, grinding, and cleaning can create high employee exposures to dusts. Some of these materials also contain toxic materials such as silica or heavy metals. Use additional ventilation or modify the work procedure to reduce dust levels as much as possible.

Industrial hygiene monitoring may be needed to assess the hazards and determine the proper protective procedures and equipment required.

If you think that toxic gases or dusts may be a problem in confined spaces you are working in - contact your Headquarters or District Safety Office for assistance.

4) Poor Ventilation

Confined spaces generally require four air changes per hour to maintain a safe atmosphere. If natural ventilation is not sufficient, then mechanical ventilation systems, either built-in or portable, must be provided. [As a general rule, if you can feel the air movement on your face, the natural ventilation is probably sufficient but testing the air is the only way to be sure.]

NOTE: Air monitoring is required in all cases before confined spaces are entered. DO NOT RELY ON VENTILATION ALONE FOR PROTECTION.

If mechanical ventilation is required, only approved equipment will be used. Makeshift fans and blowers are not acceptable. **Never use compressed air or welding oxygen to ventilate confined spaces.** Portable blower fan units should be capable of circulating at least 1200 cubic feet per minute (CFM) and be equipped with a flexible hose long enough to reach the bottom of the confined space and/or the work area.

Always ventilate by blowing air into the space. Place the air discharge hose near the bottom of the space, so that air freely circulates to all corners. This is much more effective than drawing contaminated air from the space. Be sure an opening is provided to allow air to escape. Beware of "short circuits" that allow air to enter and escape without circulating. Position the blower fan intake so that vehicle exhaust gases or other contaminants are not blown into the space. Position the hose to minimize bends and kinks, which can increase resistance and reduce airflow.

Monitor the air before ventilating to determine if air contamination exists and to check the space's "natural" state. If contaminants are present, ventilate the space for at least 15 minutes. This should provide ample circulation to flush contaminants from the space.

Retest the air to ensure that contaminants are controlled. Continue the ventilation and testing as needed to ensure a hazardous condition does not develop. Ventilation is always recommended in confined spaces, even if air contaminants are not detected.

IN ALL CASES, AIR MONITORING WILL BE CONDUCTED BEFORE THE CONFINED SPACE IS FIRST ENTERED.

Additional monitoring may be waived if conditions inside and outside the space do not change. (This is possible only if operations inside the space do not use or generate hazardous substances.)

If operations that consume oxygen (welding, burning, heating, etc.) or produce contaminants (painting, cleaning, grinding, sandblasting, shotcreting, etc.) will be done in or near the confined space, additional ventilation beyond four (4) air changes per hour may be required to control the hazard.

Hot operations, particularly welding or cutting on coated metals (galvanized or painted) require additional ventilation equipment to remove the smoke and fumes from inside. (This is in addition to the ventilation equipment pushing air into the space.)

b) PHYSICAL HAZARDS

Physical Hazards are the second category of unique confined space hazards that require special training, work procedures, and equipment. Physical hazards include the following:

- **Difficult Entry/Exit**

By definition, entry into confined spaces is difficult. Entry/exit openings are usually small in size and difficult to move through easily. Movement within the space is typically difficult with small openings, vertical ladders, small landings, and multiple levels. Movement of employees or equipment in and out of these spaces is difficult, particularly if an employee is injured.

Special training, equipment, and safety devices are required to perform rescues from confined spaces. Because Caltrans employees are typically not trained or supplied with this equipment, coordination with local fire departments and rescue squads is essential.

Knowing how the local fire department or rescue squad will respond to a confined space emergency is a required part of the planning for a confined space entry. Discuss notification procedures and confined space locations with rescue agencies before the work begins.

The name and contact information for the rescue provider must be immediately available at all confined space operations. If the local fire department or rescue squad cannot provide emergency rescue service, alternate methods such as a contract with a rescue service provider or Caltrans rescue team must be provided.

These alternative rescue services will be reviewed and approved by the Headquarters or District Safety and Health Office before they are implemented.

Note: Emergency confined space rescue requires specialized rescue equipment and training, including frequent drills and periodic retraining.

- **Communication**

An additional concern related to the difficult entry/exit of confined spaces is communication between those in the confined space and those outside.

A system of communication, such as two-way radio, verbal signals, hand signals, rope pulls, etc., must be established and understood by all participants before entering the space.

- **Insects/Birds/Rodents**

Because they provide an ideal natural habitat, confined spaces often contain insects, birds, rodents, spiders, snakes, and other animal life. Many of these creatures can inflict painful bites or carry harmful diseases, so avoiding contact with them and their droppings is the best procedure. Use insect sprays or mechanical means to remove them from the area, but **be aware that insect spray may create a toxic atmosphere**. Use work practices/methods that minimize airborne dust. Do not handle dead rodents, birds, or rodent/bird droppings with bare hands, as they may be a source of disease or virus. Use coveralls to avoid contaminating clothing. Be sure to wash hands and face before eating, drinking, or smoking.

- **Lighting**

Because of their configuration, confined spaces usually have poor lighting and visibility. Extra illumination is usually required to perform work inside confined spaces. Lights used in confined spaces must be grounded and suitable for wet locations with the bulb protected against breakage. Lights must be explosion proof unless air testing is provided. **Never turn on a light or electrical device in a confined space until the air has been tested.**

- **Wet Conditions, Slips, Trips, and Falls**

Confined spaces can involve wet conditions and uneven working surfaces. Mud and debris may hide drop offs, slopes, protruding pipes and valves, or other slip, trip, and fall hazards. Footing can be uncertain. Always proceed cautiously with good illumination. Wear appropriate footwear to prevent contact and minimize slipping.

- **Ladders**

An additional source of slip, trip, or fall hazards is ladders. Ladders are often the only means of access into confined spaces. Always climb ladders properly: face the ladder, use both hands, do not carry materials or equipment, rest at landings if tired.

- **Floors/Manhole Openings (Access openings)**

Entry into confined spaces often requires the removal of covers, grates, or manhole covers to gain access. If employees or equipment can fall into or through the access opening, portable guardrails or equivalent barriers shall be used to guard the opening.

- **Equipment (Lockout/ Tagout)**

Equipment located inside confined spaces can create special hazards, particularly if it is controlled from a remote location. Unexpected movement or actuation of valves, pipes, solenoids, actuators, fans, shafts, motors, pumps, or other equipment inside the space while workers are in the area could cause serious injury.

If unexpected movement or start-up would be a danger to employees, the equipment that moves or could move must be positively locked-out, de-energized, blocked, secured, and or guarded to prevent employee contact. Locations that remotely control the equipment must be notified before work starts and positive steps must be taken to prevent accidental activation.

- **Heat Stress**

Because of the unique conditions of working inside confined spaces, heat stress can be a problem. Be aware of the three stages of heat stress:

- Heat Cramps - cramping in legs and arms, heavy sweating-caused by lack of minerals in the muscles. Treatment: drink fluids, rest.
- Heat Exhaustion - fatigue, nausea, headache, heavy sweating, skin clammy and moist, pale or flush complexion, blood pressure drop, fainting-caused by continued exertion and diversion of blood supply to skin and muscles. Treatment: seek medical attention, move to cooler place, drink fluids, rest.
- Heat Stroke - confusion, loss of consciousness, convulsions, hot dry red skin, no sweating MAY BE FATAL IF UNTREATED - SEEK IMMEDIATE MEDICAL HELP. Treatment: immersion/sprinkle with cool water, but do not "ice down" - that may send victim into shock.

To avoid heat stress, prepare properly through physical conditioning, acclimatizing to heat, and awareness of symptoms. During work drink plenty of fluids (1 qt. per hour), take cooling off breaks, and avoid alcohol and caffeine.

14.05 ROLES AND RESPONSIBILITIES

The District or Headquarters Safety and Health Officers are responsible to oversee the program and to ensure standardized training is given on a regular basis and that qualified trainers and instructors are available. They shall:

- Ensure that managers, supervisors, and employees follow the requirements for confined space entry as required by this chapter.
- Ensure that information about proper testing equipment is made available to managers and supervisors.
- Ensure that employees have received proper training.

The supervisor; i.e., branch chief, shop superintendent, and maintenance manager, or other appropriate position, is responsible to:

- Ensure that confined spaces in their area of responsibility are identified and recognized by employees.
- Ensure that all affected employees are trained in accordance with the instructions contained in this chapter before entering a confined space.
- Ensure that proper testing equipment is purchased and made available to supervisors and employees.
- Ensure that employees know how to use test equipment and test for hazardous gases/oxygen deficiencies in confined spaces.
- Ensure that employees understand applicable safety procedures.
- Maintain applicable records and entry forms.
- Ensure that employees know the rescue procedures.
- Ensure that required rescue services are provided/available.

In addition to the items listed above, the following roles and responsibilities will be designated and followed at all confined space entry operations.

The on-site person supervising the confined space entry (**entry supervisor**) shall:

- ensure that all required testing equipment is on-site and operating properly;
- ensure that all crew members know the possible hazards and the means, symptoms, and effects of exposure;
- verify that the confined space entry form is properly filled out;
- ensure that all required air monitoring has been done, and all confined space procedures are being followed, before signing the entry form and allowing entry to begin;
- terminate the entry when the work is completed or if conditions arise which endanger the entrants;
- verify that rescue services are available and required means of communication are operable;
- remove unauthorized people from the site and prevent their entry into the confined space; and,
- ensure that someone else will assume their duties if they must leave the site.

The lookout person (**attendant**) at the confined space entry shall:

- know the possible hazards, and the means, symptoms, and effects of exposure;
- be aware of the possible behavioral effects of exposure on entrants;
- continuously track the number and identity of the employees in the confined space;
- remain outside the confined space until relieved;
- communicate with entrants to monitor their status and alert them, if necessary, of the need to exit;

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- monitor activities both inside and outside the confined space and order entrants to exit if: a prohibited condition is detected, entrants experience behavioral effects, something happens outside the space that could endanger entrants, attendant cannot fulfill his/her duties;
 - start on-site rescue procedures (**without entry**) and/or summon additional help if needed;
 - keep unauthorized individuals away from the confined space and notify the entry supervisor and entrants if the individuals enter the confined space;
 - perform no duties that might interfere with their primary duty to monitor and protect entrants.

NOTE:

The “entry supervisor” and the “attendant” may be the same person.

All employees who will enter confined spaces (**entrants**) shall:

- follow the work procedures received during training, and as outlined in this chapter;
- use and handle the testing equipment properly;
- know the hazards, including means, symptoms, and effects of exposure;
- communicate with the attendant (lookout person) as necessary;
- alert the attendant whenever a prohibited condition, or any warning sign or symptom of dangerous exposure occurs;
- exit the confined space immediately whenever ordered to by the attendant or entry supervisor, or whenever a prohibited condition, or any warning sign or symptom of dangerous exposure occurs, or when an evacuation alarm is activated;
- follow appropriate rescue procedures; and,
- notify their supervisor of any safety concerns or questions.

14.06 TRAINING REQUIREMENTS

Before starting any work involving confined spaces, employees shall be trained in the following items:

- the Caltrans Confined Spaces Program contained in this chapter;
- the Caltrans confined spaces operating procedures described in the following section;
- the Caltrans Hazardous Materials Communication Program (See Chapter 16 in the Safety Manual); and
- the roles and responsibilities of confined spaces workers.

Confined spaces training will be provided by designated trainers who have completed a "train the trainers" course. Completed training will be documented, and recorded on the employee's training record. The designated number is G#21418.

Training will be provided before employees are allowed to enter a confined space and renewed every two years thereafter.

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14.07 OPERATING PROCEDURES

The following are the Caltrans Confined Space Operating Procedures. These are the basic requirements that must be followed by all supervisors and employees before entry into a confined space is allowed.

1) PLANNING

Before starting any work involving a confined space:

Employees will be trained on:

- the elements listed in Section 14.06 - TRAINING, above;
- the roles and responsibilities of confined space **entry supervisors, attendants, and entrants**;
- the specific physical hazards of the space to be entered;
- the hazards of the materials to be used in the space, including symptoms of over exposure;
- the entry and exit procedures;
- how emergency/rescue requirements will be satisfied [See Section 14.04(b) Physical Hazards - Difficult Entry] on page 14-10, and the name and contact information for the responders for that location; and,
- the proper use of air monitoring equipment.

All necessary safety, first aid, and monitoring equipment will be on the job site, and all necessary rescue equipment will be on the job site unless provided by the rescue responders.

The confined space work crew will coordinate with other crews working in the area (highway maintenance, surveys, construction) about their work location and schedule.

2) ENTRY PROCEDURE

Before entering a confined space:

- identify the role and duties of each employee: **entry supervisor, attendant, and entrants;**

EXCEPTION for Attendant:

The requirement for an “attendant” may be waived if all of the following conditions are satisfied:

- 1. Continuous air monitoring will be conducted during entry and while inside.*
 - 2. No hazardous materials will be used/generated/placed in the confined space.*
 - 3. No outside sources of hazardous materials that could cause an inside problem.*
 - 4. A means of communications with rescue services exists.*
 - 5. Documentation of these conditions is made at the worksite.*
 - 6. The confined space is: above ground level, or a culvert 60 inches or more in diameter that the entrant can see and walk through.*
- review the operating procedures and the work to be done, including hazards and symptoms of overexposure;
 - review how communication between entrants and attendants will be maintained;
 - review the emergency/rescue procedures [See Section 14.08(b) Physical Hazards - Difficult Entry] and the name of the rescue response agency and directions on how to contact them shall be understood and posted at the worksite;
 - verify communications with radio dispatcher, office, local agency, or other emergency rescue contact;
 - assure that air monitoring equipment has been properly maintained and calibrated, field tested, and that batteries are fully charged (or have extra batteries);

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- prevent hazardous materials or vapors from entering the confined space through pipelines, drains, gutters, automatic fire suppression systems, etc., while work is being done;
 - take appropriate steps to ensure that equipment inside the space will not start or move suddenly and that workers in the space will be protected from it; this includes notifying remote locations that control the equipment; and
 - test the air in the confined space with appropriate air monitoring equipment to determine whether dangerous air contamination, oxygen deficiency, and/or flammability hazards exist.

NOTE:

Monitoring requirements may be modified after initial entry if outside/inside conditions do not change and the work does not use or generate hazardous substances. IN ALL CASES, AIR MONITORING WILL BE CONDUCTED BEFORE THE CONFINED SPACE IS FIRST ENTERED.

- flush and/or purge the confined space with a mechanical ventilation system for at least 15 minutes if atmospheric hazards are detected;
- retest the air to ensure that contaminants have been removed; and/or
- **IF TESTING SHOWS THAT THE AIR IN THE CONFINED SPACE IS STILL HAZARDOUS, TRY REVENTILATING AND RETESTING. IF THE AIR STILL TESTS HAZARDOUS - STOP - DO NOT ENTER – NOTIFY THE ENTRY SUPERVISOR ***

* NOTE:

If entry must be made in hazardous air conditions, special equipment and training are required. Written approval must be obtained from Headquarters/District Safety and Health Office before entry is allowed.

- Document that safe work procedures (including air monitoring) are being followed at the worksite by recording:
 - names of each entrant,
 - name of attendant,
 - name of entry supervisor,
 - date and time of each entry and exit,
 - record of initial % of oxygen,
 - record of initial % Lower Explosive Limit value,
 - record of periodic meter readings or notation that continuous monitoring was used, and
 - record of initial ppm readings for Carbon Monoxide/Hydrogen Sulfide (if applicable).

NOTE:

Caltrans personnel will use the "CONFINED SPACE ENTRY FORM", formerly "PERMIT FOR CONFINED SPACE ENTRY", to satisfy the written record requirements. (See Section 14.13 of this chapter.)

3) DURING WORK IN A CONFINED SPACE:

- Provide continuous ventilation while employees are in the confined space;

Exception:

Those locations where air monitoring indicates no hazard and the work inside the space does not use or generate hazardous substances, and outside/inside conditions do not change.

- Provide continuous air monitoring and log the results.

NOTE:

Monitoring requirements may be modified if outside/inside conditions do not change and the inside work does not use or generate hazardous substances.

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- **IF AIR BECOMES HAZARDOUS -IF ALARM SOUNDS - GET OUT IMMEDIATELY! DO NOT REENTER - NOTIFY ENTRY SUPERVISOR***

*** NOTE:**

If entry must be made in hazardous air conditions, special equipment and training are required. Written approval must be obtained from Headquarters/District Safety and Health Office before entry is allowed.

- maintain communication between the entrants and the attendant;
- ensure that suitable lighting is provided in the confined space;
- ensure that equipment within the space remains de-energized, disconnected, locked, blocked;
- ensure that floor/manhole openings are guarded so entrants or equipment can not fall into opening; and
- do not allow ignition sources in the confined space. (Smoking is prohibited.) If torches, burners, welders, etc., must be used, additional protective measures, including local exhaust ventilation, fire control procedures, and equipment, monitoring, and training must be provided, and documented.

(Contact the Headquarters/District Safety and Health Office for assistance in meeting these requirements.)

NOTE:

The procedures in this section are the minimum requirements and must be provided to all Caltrans employees engaged in confined space work on any project.

Required procedures may be provided by a contractor or others depending upon the operation and/or jurisdiction.

Copies of this chapter may be given to others, but, Cal-OSHA regulations require that each employer working in confined spaces have their own written procedures and a confined space program.

14.08 EMERGENCY/RESCUE PROCEDURES

Because Caltrans employees will not enter confined spaces with hazardous atmospheres, the most probable emergencies to be encountered will be slips, trips, falls, heat stress, cuts, chemical exposure, or heart attack/seizure. Generally, these emergencies will be handled in the same manner as non-confined space emergencies.

If the employee is incapacitated and cannot leave the confined space without special rescue assistance, follow the rescue plan prepared before entry began. See Section 14.04(b) Physical Hazards - Difficult Entry/Exit, on page 14-10, and Section 14.07(1) Planning, on page 14-17.

While waiting for rescue services to arrive, carry out the following procedures:

- 1) Entrants will provide first aid to the injured employee and notify the attendant of the emergency.
- 2) Attendant will notify entry supervisor and initiate emergency rescue procedure by notifying rescue agency.
- 3) Attendant will not enter the confined space or leave the scene unless another attendant assumes his/her duties.
- 4) The injured person will not be moved unless they are in a life threatening situation.
- 5) Move ventilation source to near the injured person and maintain verbal and visual contact with them.
- 6) Continue to monitor the conditions inside and outside the confined space, including air monitoring inside the space, until rescue services arrive.

14.09 WET/DRY PIT PUMPING PLANTS

Wet pit pumping plants generally have the electrical motors and electrical control equipment located at ground level (motor room floor). The pumps are located in the pit below the ground level and are controlled from above. Access to the pump pit is by ladders and landings.

Because the pumps are placed directly into the open water collection chamber (the wet pit), these plants usually rely on natural ventilation coming through the collection chamber. Because the potential exists that hazardous materials could enter the open chamber through the drainage system, it is essential to do air monitoring before pumps, motors, or lights are turned on.

Dry pit pumping plants generally have electrical control equipment located on the balcony or at ground level. The pumps and motors are located in the dry well below the electrical equipment floor or balcony. Access to the pumps and motors is by ladders and landings.

Because the pumps are separated from the collection chamber by a wall, these plants have little natural ventilation and are usually equipped with a mechanical ventilation system. A leaking or defective pump could allow hazardous materials that get into the collection chamber to enter the dry pit, with the possibility that a hazardous atmosphere could be created. Air monitoring is required before lights, motors, or pumps are turned on.

Both wet and dry pit pumping plants may have locations that have good access, and therefore do not meet the definition of a confined space.

These areas may be entered without air testing, but because of the potential for hazardous atmospheres at the below grade (pit) locations, monitoring below grade must be done before pumps, motors, or lights are turned on (unless the motors and lights are explosion proof).

The areas below the motor room floor are confined spaces and will not be entered without air testing.

14.10 GASOLINE OR DIESEL POWERED EQUIPMENT IN CONFINED SPACES

The use of gasoline or diesel powered equipment in confined spaces creates special hazards and has special requirements.

Engine powered equipment such as generators, welders, drills, saws, pumps, tunnel tugs, etc., generate exhaust gases that contain carbon monoxide and other harmful materials. They must not be used in confined spaces unless special precautions and protective measures have been implemented.

It is essential that exhaust gases be piped or removed from the space, and that good ventilation and continuous air monitoring (particularly for carbon monoxide) be provided. The usual (4) four air changes per hour may not provide adequate protection.

The entry supervisor shall document the special measures taken to address the hazards before he/she allows engine powered equipment to be used in the space.

* * * * *

The following section covers Gasoline or Diesel Powered Equipment Used in Confined Spaces During “Tunnel” Operations.

Operations involving the cleaning, repair, or construction of large pipes or culverts that personnel and equipment can enter could be considered “tunnel” work based on Cal-OSHA regulations.

Whenever Caltrans is required to conduct "tunnel" operations, they must comply with the following regulations, or hire a contractor who must comply with the following regulations:

- 1) Have a pre-job meeting with the Cal-OSHA Mining and Tunneling Unit to have the "tunnel" classified and review the safety requirements.
- 2) Obtain an underground operation permit from Cal-OSHA for each machine used in the tunnel.

Equipment must be diesel powered and equipped with approved catalytic converters or exhaust scrubbers.

Gasoline powered equipment is generally prohibited, unless sufficient ventilation is provided.

NOTE:

*As a public agency, Caltrans is exempt from this permit requirement.
Contact the Headquarters or District Office of Safety and Health for assistance.*

- 3) Provide a ventilation system that meets the capacity requirements based on brake horsepower of equipment and number of workers in the tunnel.
- 4) Provide trained "gas testers" to monitor the air inside the tunnel at regular intervals.
- 5) Have an acceptable written safety program.

NOTE:

The five (5) above listed requirements do not apply to Caltrans operations at the Posey/Webster Tubes or the Caldecott Tunnels.

14.11 AIR MONITORING EQUIPMENT SELECTION

The criteria given below are based on the assumption that the air monitoring equipment has been properly maintained and calibrated. Alarms must be set to activate at 19.5 percent for oxygen and 10 percent for lower explosive limit (LEL). Carbon monoxide and hydrogen sulfide alarms shall be set at 35 ppm and 10 ppm, respectively (unless set at a lower level by the manufacturer). Monitoring equipment that cannot be set at these levels or that is not operating properly cannot be used.

To aid Caltrans employees in selecting the correct air monitoring equipment for confined spaces, the following criteria will be used:

- 1) air monitoring equipment that monitors only oxygen and flammable gases (standard two gas units) can be used:
 - if the location has good ventilation (natural or mechanical); and
 - carbon monoxide and/or hydrogen sulfide are not expected (i. e.; large open culverts, ventilation tunnels, drop inlets, etc.); and
 - there are no previous indications that additional toxic materials may be present; and
 - the work being done and materials being used inside the space cannot create or release toxic air contaminants.

NOTE:

If workers experience symptoms of exposure, work will stop until the cause is determined. Air monitoring for additional toxic air contaminants may be required.

- 2) air monitoring equipment that monitors for carbon monoxide, in addition to oxygen and flammable gases, will be used:
 - in locations with poor ventilation; or
 - where carbon monoxide would be expected (bridge cells, tunnels, pump houses, etc. - especially when motorized equipment or vehicles are operated nearby); or

-
- in locations where carbon monoxide has been detected in the past; or
 - in locations where work done inside the space (burning, welding, brazing, heating, cutting, etc.) could create carbon monoxide; or
 - if workers inside the space experience symptoms of exposure to carbon monoxide (headache, dizziness, weakness, drowsiness, nausea).
- 3) air monitoring equipment that monitors for hydrogen sulfide, in addition to oxygen and flammable gases, will be used:
- in locations with poor ventilation; or
 - in locations where hydrogen sulfide would be expected (pump houses, sewer/drainage lines, drainage storage chambers, sumps, blocked or obstructed culverts, etc.); or
 - in locations where hydrogen sulfide has been detected in the past; or
 - in locations where employees working inside the space may release hydrogen sulfide (opening sealed sewage/drainage lines or pumps, disturbing decaying organic matter inside chambers, culverts, or pipes, entering septic tanks or clarifiers, etc.); or
 - if workers inside the space experience symptoms of exposure to hydrogen sulfide (eye irritation, drowsiness, strong "rotten egg" smell).
- 4) locations that do not meet the criteria given above shall be monitored for carbon monoxide, hydrogen sulfide, oxygen and flammable gases before entry.

SPECIAL NOTE:

THE OFFICE OF SAFETY AND HEALTH STRONGLY RECOMMENDS THAT ALL NEW MONITORING EQUIPMENT BE PURCHASED EQUIPPED WITH ALL FOUR SENSORS, TO ALLOW ITS USE IN ALL CALTRANS CONFINED SPACES.

14.12 AIR MONITORING INSTRUMENTS

Caltrans generally uses four (4) types of sensors in its air monitoring instruments for confined spaces: Combustible Gas Indicator (CGI or LEL meter), Oxygen Level Meter, Carbon Monoxide Sensor, and Hydrogen Sulfide Sensor.

Combustible Gas Indicator (CGI or LEL meter)

This sensor measures for the presence of flammable vapors in the air giving a reading as a percentage (%) of the lower explosive limit (LEL). It is not gas specific and measures only for the combustibility of the tested air.

Because combustibility depends on oxygen levels, this sensor operates properly only at oxygen levels above 19.5 % and below 23.5 %. Low oxygen levels will cause an artificially low LEL reading, while high oxygen levels will cause an artificially high LEL reading. The alarm on this type of sensor will activate at 10% of the LEL.

CGI's are calibrated to the calibration gas recommended by the manufacturer (generally methane gas). Lead gasoline and silicone vapors can "poison" the sensor and cause incorrect readings or failure. Excessive saturation of the sensor with high LEL exposures will shorten sensor life. CGI sensors usually last at least two (2) years.

Oxygen Level Meter

This sensor indicates the oxygen level in the air giving a reading of the percent (%) of oxygen in the air. The alarm on this instrument will activate at oxygen levels less than 19.5% or more than 23.5 % oxygen. Oxygen sensors have a limited life span, typically 12-18 months, and should be replaced as recommended by the manufacturer. (Some new models are guaranteed to last 24 months.)

NOTE:

The life span of oxygen sensors begins when the sensor is manufactured, so maintaining a large stockpile of additional sensors may not be advisable.

Other Sensors

Carbon monoxide and hydrogen sulfide sensors measure the concentration of these materials in the air and give the results in parts per million (PPM). The carbon monoxide alarm is set at 35 ppm, the hydrogen sulfide alarm at 10 ppm. These are the Cal-OSHA Permissible Exposure Limit (PEL) for these particular materials, but some manufacturers set the alarm lower. (They typically have a life span of 18-24 months and should be replaced as recommended by the manufacturer.)

Calibration

To ensure that air monitoring instruments are operating properly, they must be calibrated and tested regularly. Calibrations are divided into two types:

- 1) **"field"** calibration or function test - Done on a daily basis, or each time the instrument is used, to check that the sensors are functioning properly:

- A "breath test" with exhaled air to test the oxygen meter (exhaled air is low in oxygen);
- A "lighter test" with a butane lighter or calibration gases to check the CGI; and/or

CAUTION: Do not overexpose the sensor! This will cause premature sensor failure.

- A "challenge test" of other sensors with their calibration gas or a "bump" gas (if available) .

- 2) **"bench"** calibration - A calibration and adjustment of the instrument sensors performed at least monthly (or before each use if not at least monthly). This calibration must be done according to manufacturer's recommendations and by a trained person. Calibration gases are used for this procedure, which includes adjusting meter responses and checking alarm settings. (Sensors that require large adjustments during calibration probably are near the end of their useful life.)

NOTE:

Air monitoring instruments that cannot be or are not calibrated, or that do not pass the above tests, shall not be used. They shall be removed from service until repaired.

Records indicating calibration dates, repairs, sensor changes, and maintenance of each instrument shall be maintained with the instrument.

Calibration and/or operation is dependent on the condition of the instrument's batteries. Batteries should be checked before calibration/use.

14.13 DOCUMENTATION - CONFINED SPACE ENTRY FORM

To ensure that confined space procedures are being followed and to provide a record of confined space entries, it is essential that all entries into confined spaces be documented.

Caltrans personnel will use the "CONFINED SPACE ENTRY FORM", formerly known as the "PERMIT FOR CONFINED SPACE ENTRY" to document their confined space entries. This form shall be filled out and signed by all work crew members before any work begins and before entering a confined space.

The required entries include:

- names of entrants (employees),
- names of attendants(s) (lookout personal),
- name of entry supervisor,
- date and time of each entry and exit,
- record of initial % of oxygen,
- record of initial % Lower Explosive Limit (LEL) value,
- record of periodic meter readings or notation that continuous monitoring equipment was used, and/or
- any other relevant information.

The confined space entry supervisor is responsible to ensure that this documentation occurs. (In locations where a joint Caltrans - contractor entry takes place, the Caltrans employee will obtain copies of the contractor's completed entry form, or record the information on an equivalent form for Caltrans records purposes.)

The supervisor of the confined space work crew shall notify any other crew working in the area (such as highway maintenance, surveys, construction) of their work location and work schedule before entering the confined space.

The "CONFINED SPACE ENTRY", Form PM-S-0040A and B, is a bright yellow 5 inches X 8 inches card. A sample of the card is included at the end of this chapter.

NOTE:

THE COMPLETED ENTRY FORM (or equivalent) MUST BE AVAILABLE AT THE CONFINED SPACE WORKSITE BEFORE THE WORK BEGINS. THE SUPERVISOR SHALL EXPLAIN THE INFORMATION ON THE CARD TO EACH EMPLOYEE BEFORE ENTRY.

Supervisors shall retain the entry form for one (1) year.

14.14 REQUIREMENTS FOR CONTRACTORS

If contractors are required to work in a Caltrans confined space, provisions shall be made to notify the contractor:

- 1) that the space may contain hazardous atmospheres and that a confined space entry program is required;
- 2) the nature of the hazardous atmosphere, if known, and all other information about the space known to Caltrans;
- 3) any precautions or procedures instituted by Caltrans for worker protection in or near the space ;
- 4) coordinate entry procedures with the contractor if Caltrans employees will be working in or near the space; and,
- 5) apprise the contractor of the need for a debriefing with Caltrans about the confined space after the contractor has completed their work in the space. The briefing will focus on hazards encountered or created by the contractor while working in the space.

NOTE:

The information gathered at the contractor de-briefing will be recorded and passed on to the supervisors of Caltrans employees who may enter the space at a latter time.

The Resident Engineer or contract administrator/supervisor of the job is responsible to ensure that the above requirements are complied with.

* * * * *

14.15 CONFINED SPACE GUIDELINES - A QUICK REVIEW CHECKLIST

Is it a Confined Space?

- people can enter
- difficult access/egress
- not for continuous occupancy

Training?

- roles and responsibilities
- hazards
- procedures
- instruments

Before you start

- nearest medical facility
- rescuers
- air monitoring equipment - "field calibration"
- do we know what's going on inside (hazmats or processes)
 - If hazmats/processes - Do we know what to do?
 - If you don't know - Don't go, Stay out!
- going on outside (exhaust [CO], hazmat processes)?
 - If hazmats/processes will effect inside, Stay out!
- does someone know we're entering (check in - check out)?

Entering

- has air been tested?
 - unknown - test
 - known (recent) and no changes/hazmat - don't need to retest
 - known but changes/hazmat - test
- NOTE: initial test even with ventilation to verify effectiveness
- WRITE IT DOWN! - use "Confined Space Entry Form"
- maintain communications with someone outside
- have conditions changed?
 - odors, smells, symptoms, alarms, spills, injury, illness - inside
 - accidents, spills, fire - outside

IF CONDITIONS CHANGE, GET OUT! - REEVALUATE BEFORE REENTRY

After the entry

- let someone know you're out
- debrief with contractor (if appropriate)
- pass appropriate information on to those who are affected
 - maintenance, construction, other inspectors
- keep record of entry (one year)

Questions?

- Review contents of this chapter
- call District or Headquarters Safety and Health Office
- call Construction Safety Coordinators

CONFINED SPACE ENTRY FORM**FORM PM-S-0040A (SIDE A)**

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION CONFINED SPACE ENTRY CHECKLIST PM-S-0040A (REV. 5/1998)		FORM AUTHORIZED FOR ONE SHIFT ONLY NEW FORM MUST BE COMPLETED FOR EACH SUBSEQUENT SHIFT	
<i>This form must be readily available at the confined space during the time work is in progress. After work is completed, give to your supervisor for retention.</i>			
DESCRIBE WORK TO BE DONE			
DATE AUTHORIZED	TIME AUTHORIZED FROM TO		
LOCATION OF CONFINED SPACE			
LOCATION OF WORK WITHIN CONFINED SPACE (DRAW SKETCH BELOW, ESTIMATE AND SHOW DISTANCE AND DIRECTION FROM WORK ACCESS)			
<h1>Sample</h1>			
PRE-WORK APPROVAL	CREW SUPERVISOR'S SIGNATURE	DATE (Must be signed on date of issue)	
CONFINED SPACE ENTRY APPROVAL	ENTRY SUPERVISOR'S SIGNATURE	DATE (Must be signed on date of issue)	
EMPLOYEES AUTHORIZED TO ENTER CONFINED SPACE			
ENTRY SUPERVISOR			
LOOKOUT PERSON/ATTENDANT			
ENTRANTS			
CHECKLIST ON OTHER SIDE MUST BE COMPLETED BEFORE ENTRY			

CONFINED SPACE ENTRY CHECKLIST**FORM PM-S-0040B (SIDE B)****CONFINED SPACE ENTRY CHECKLIST**

PM-S-0040B (REV. 5/1998)

NOTE: THE ENTRY SUPERVISOR INITIALS ITEMS 1-3 AND 5-7. ENTER SPACE ONLY AFTER THE PROCEDURES LISTED BELOW HAVE BEEN COMPLETED.

INITIAL

1. Review *Code of Safe Practices* for entry and work in confined spaces. _____
2. Review emergency/rescue procedures. Ensure emergency rescue equipment/personnel are available for removing disabled worker from space. _____
3. Assure that confined space has adequate ventilation. _____

4. Atmospheric testing	ENTRANCE		INSIDE	
	METER READING	INITIAL	METER READING	INITIAL
% Oxygen				
Combustibles (%Lower Explosive Limit - LEL)				
Carbon Monoxide				
Hydrogen Sulfide				

NOTE: If the atmosphere tests hazardous, **STOP - DO NOT ENTER**; contact entry supervisor. Hazardous is defined as oxygen level below 19.5%, or a combustible gas content greater than 1% LEL, or carbon monoxide greater than 25 ppm, or hydrogen sulfide greater than 10 ppm.

INITIAL

5. Suitable lighting provided in work area. _____
6. Effective means of providing continuous communication between standby person and worker(s) in confined space. _____
7. Assure that atmosphere will be tested during work within confined space.
NOTE: If atmosphere becomes hazardous, all workers shall **STOP WORK** and **LEAVE CONFINED SPACE IMMEDIATELY - DO NOT RE-ENTER**; contact entry supervisor. _____

I have determined to my satisfaction that the above procedures have been completed and it is safe to enter and work in this confined space.

ENTRY SUPERVISOR'S SIGNATURE _____

LOOKOUT PERSON/ATTENDANT'S SIGNATURE _____

INITIALS OF OTHER WORKERS/ENTRANTS ENTERING CONFINED SPACE

PUMP HOUSE MAINTENANCE

HAZARD REVIEW

Explosive Hazards
Oxygen Deficient Atmosphere
Footing and Falling Hazards

SAFE OPERATING PROCEDURES

1. Review safe practice rules for applicable equipment (including rental equipment), perform pre-operational checks and review Confined Space Entry Procedures (see Appendix B).
2. Do not go below floor level prior to notifying Area Supervisor or Area Superintendent, and the local dispatcher.
3. Before entering a confined space, a "Confined Space Pre-Work Check List" shall be posted at the work site and must be completed and signed by all employees involved in entering the confined space before entry into the confined space.
4. All employees, including standby persons, shall be trained in the operating and rescue procedures, including instruction as to the hazards they may encounter.
5. Employees entering confined spaces should be in good physical condition and psychologically suited for the job.
6. At least one person shall stand by on the outside of the confined space ready to give assistance in case of emergency.
7. Smoking or open flames shall not be permitted in any area of the structure. "No Smoking" signs shall be posted on all exterior doors of the pump house. If cutting or welding is required, remove the object to outside area, if possible. If removal is not possible, remove all grates, manhole covers and set up mechanical ventilation to provide maximum ventilation in the work area. Respiratory protection may be required.
8. The area shall be ventilated for a minimum of 15 minutes prior to atmospheric testing and entry. Pumping plants with wet pits need not be ventilated if the crew leader determines that the updraft of air is sufficient to indicate the natural ventilation system is functioning and the atmosphere required tests are satisfactory.
9. Atmospheric tests must be conducted by a trained and qualified person prior to any employee descending below the entry level of the pump house. If it is determined from the initial test, that the lower explosive level and oxygen levels are within acceptable and legal standards as mandated in Article 108 of the General Industrial Safety Orders, Title 8, California Code Regulations, then entry below the main floor may proceed. The air shall be continually monitored with an appropriate instrument for combustible gases and oxygen-deficient atmosphere. A record of such tests shall be kept at the job site. **Should the atmospheric-testing instrument's audible alarm or visual indicator indicate a change, all individuals must evacuate the area immediately.**
10. Atmospheric detection instruments shall be stored at Supervisor, Area Superintendent, and Region Manager's office. These shall be certified annually and checked before each use. Detection instruments not operating properly shall not be used.
11. During the initial testing of structure for atmospheric conditions, all employees must remain at floor level.
12. A radio-equipped vehicle must be at the location when an employee(s) will be below the floor level. The radio shall be checked with local dispatcher for communication capabilities at the location.
13. One person must remain at floor level at all times, and visual or verbal communication must be constantly maintained with employee(s) below the floor level.
14. **WRITTEN EMERGENCY RESCUE PROCEDURE MUST BE LOCATED IN PUMP HOUSE AND AT THE LOCAL DISPATCH OFFICE READILY AVAILABLE AT ALL TIMES. THE STAND-BY PERSON (S) SHALL FOLLOW THE WRITTEN EMERGENCY RESCUE PROCEDURES.**
15. Notify the local dispatcher when all work below floor level has been completed and all employees have safely returned to floor level.
16. If the above conditions cannot be obtained, no one shall enter the confined space.

APPENDIX B

CONFINED SPACE ENTRY PROCEDURES

CONFINED SPACES INCLUDE STRUCTURES OR FACILITIES, SUCH AS: TANKS, BINS, CULVERTS, MOBILE TANKERS, VAULTS, PUMP HOUSES, DEEP TRENCHES, BRIDGE CELLS, OR SIMILAR LOCATIONS.

HAZARD REVIEW

Explosive Hazards
Oxygen deficient atmosphere

SAFE OPERATING PROCEDURES

1. All employees, including standby persons, shall be trained in the operating and rescue procedures, including instructions in the hazards they may encounter. Refer to Safety Manual, Confined Spaces, Chapter 14.
2. Employees entering confined spaces should be in good physical condition and psychologically suited for the job.
3. Before entering a confined space, a "Confined Space Pre-Work CheckList" shall be posted at the work site and must be completed and signed by all employees involved in entry into the confined space. Notify regional dispatcher prior to entry and when exiting a confined space.
4. Smoking or open flames shall not be permitted in the immediate area of the confined space.
5. Atmosphere tests using a Gastech (or equivalent) air sampling and monitoring instruments must be conducted by a trained and qualified person prior to any employee entering confined space. The instrument shall be tested prior to use by a qualified person who can ensure that the unit is functioning properly and that the batteries are not low. Low batteries will result in false readings that could be dangerous or fatal. If it is determined from the initial test, that the lower explosive level and oxygen levels are within acceptable standards, then entry may proceed. The air shall be continually monitored with an appropriate instrument for combustible gases and oxygen-deficient atmosphere. A record of such tests shall be kept at the job site for the duration of the work.
6. If the above conditions cannot be met, no one shall enter the confined space.
7. The area shall be ventilated for a minimum of 15 minutes prior to atmospheric testing and entry. Culverts need not be ventilated if the crew leader determines that the natural ventilation system is sufficient and the required atmospheric tests are satisfactory. **Should the atmospheric-testing instrument's audible alarm or visual indicator, indicate a change reduction in oxygen content or increase of gas, all individuals must evacuate the area immediately.**
8. At least one person shall stand by on the outside of the confined space ready to give assistance in case of emergency.
9. An emergency rescue plan shall be devised and discussed prior to entry into any confined space.

CONSTRUCTION PROGRAM
CODE OF SAFE OPERATING PRACTICES
APPENDIX A1 – CONFINED SPACE ENTRY PROCEDURES

- Immediately prior to entry, verify radio communications with the radio dispatcher, RE Office or the Highway Patrol for possible emergency rescue.
- Review emergency/rescue procedures. The name of the Rescue Response Agency and directions on how they should be contacted shall be posted at each worksite.
- The space shall be emptied, flushed, or otherwise purged of flammable, injurious or incapacitating substances to the extent feasible.
- Assure that the space has continuous ventilation (natural or mechanical). Minimum 15 minutes or continuous.
- The air shall be tested with an appropriate device to determine whether dangerous air contamination, oxygen deficiency and/or explosive hazard exists.
- A written record of the testing results shall be maintained at the work site. IF THE SPACE ATMOSPHERE TESTS HAZARDOUS – STOP DO NOT ENTER!
- “Hazardous” is defined as an atmosphere, which after venting, has an oxygen level below 19.5% by volume or a combustible gas content greater than 20% of its lower explosive limit (LEL).
- Maintain a log at the worksite for recording:
 - Name of person(s) entering enclosed space
 - Name of standby person
 - Date and time of each entry and exit
 - Initial % Oxygen
 - Initial % Lower Explosive Limit value
 - Periodic meter readings or notation that continuous monitoring equipment was used
- Assure that suitable lighting is provided in the work area.
- At least one standby person shall remain outside the enclosed space with an effective means of communication with the person(s) within the enclosed space and with the radio dispatcher, RE office or Highway Patrol.
- Testing of the atmosphere shall be conducted with sufficient frequency to ensure that the development of dangerous air contamination and/or oxygen deficiency does not occur during the performance of any operation.
- IF THE ATMOSPHERE BECOMES HAZARDOUS, ALL PERSONS ARE TO VACATE THE ENCLOSED SPACE IMMEDIATELY! Do not re-enter!!
- Notify the radio dispatcher, RE office or Highway Patrol upon exiting the enclosed space.

CONSTRUCTION PROGRAM
CODE OF SAFE OPERATING PRACTICES
CONFINED/ENCLOSED SPACE PROCEDURES

A confined space is defined by the concurrent existence of the following condition:

- Existing ventilation is insufficient to remove dangerous air contamination and/or oxygen deficiency which may exist or develop.
- Ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s).

An enclosed space is defined:

- Such spaces as tanks, vessels, compartments, ducts, sewers, pipelines, vaults, bins, tubs, pits, column forms and drainage systems.
 - Areas cleared from requirements for confined spaces.
1. No employee SHALL enter or remain in confined space or an area otherwise known to have an atmosphere deficient in oxygen or containing harmful amounts of dusts, gasses, or other substances.
 2. Prior to being authorized to enter enclosed spaces, employees SHALL review the Code of Safe Practices, Appendix A-1 "Confined Space Entry Procedures". Employees entering enclosed spaces SHALL be trained in the proper use of the atmospheric monitoring equipment, entry procedures, hazard detection and emergency action plans.
 3. Employee entering enclosed spaces SHALL use the procedures shown in Appendix A-1 "Confined Space Entry Procedures".